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What determines crime in Russian regions?*

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Abstract.

This paper presents a simple model of a rational offender based on cost-benefit analysis with uncertain income and costs. In the empirical part we estimate a system of dynamic crime supply equation and its first difference by using Generalized Method of Moments with moment conditions generated by assumption of endogeneity of explanatory variables. We use a set of socio-economic, demographic and other indicators as explanatory variables, including proxies for criminal experience, alcohol and drug consumption, and the strength of Police. Data used are panel data from 1990 to 1998 for 70 Russian regions. In the study crime is represented by homicide and larceny as proxies for violent and property crimes respectively. Both types of crime are found to be persistent over time. There is a strong deterrent effect arising from Police activity but this effect is very restricted indicating that law enforcement activity is important but could not prevent further crime growth. High level of education prevents people from committing either types of crime. Dramatically increasing drug consumption led to a rise in either type of criminal activity. Higher alcohol consumption is found to be responsible for growth in violence during transition. Moreover, in spite of common belief on the West, the largest part of homicides is not associated with criminal gangs but a result of outbreak of aggression within family and neighborhood generally caused by alcohol intoxication. Family disruption in 90-es is also highly responsible for crime growth showing both worsened income paths and less child control in broken families. Other socio-economic indicators have an opposite impact on violent and property crimes. We find that with higher income inequality, and lower real income and unemployment rate property crimes are (lower but violence is higher) substituted by violence.

JEL classification: K14, K42.

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Contents.

Introduction.

It is quite clear that epochal changes in economic, social, political environment in Russia could be resulted in changes of people incentives to criminal activity. The state lost its control over the people minds and they accommodated fast to new conditions of freedom. Changes in moral norms have made Russians more patient to previously unacceptable activities. As a result society was engulfed in a criminal deluge. No need to say that high stress from reforms and worsened economic conditions was aggravated by felling of unsafety when people are in fear of their lives.

The purpose of this project is to shed some light on possible factors of crime growth in Russia during transition. Among the causes of crime growth mentioned in a public opinion poll held in 1991, the main answers were (i) a fall in the standards of living (mentioned by 73 % of respondents), (ii) passivity and indecision of the authorities (56 %), (iii) failure to punish the offenders (50 %).

It is commonly accepted that democratization of society and transition to market is inevitably accompanied by such an evil as the high total crime rate (e.g. emergence of private property leads to lucrative crime against it). However, some other negative consequences from openness in Russian society are on the surface, like increased intentional and planned homicides, economic crimes and drug spreading. The last two types of crime have shown the most drastic increase and are responsible for the dramatic growth in total crime rate in Russia during the 90-es.

Now, Russia has an entire range of social problems previously associated only with capitalist society, i.e. poverty, unemployment, inequality, homelessness, drug addiction, along with other peculiarities, such as wage arrears, nonpayment, barter, high corruption, etc. All of them could be the causes and partially the consequences of crime growth in Russia.

This study is the first empirical paper on factors of crime in Russia. We want to check whether drastic changes in social and economic indicators, such as income decline, rise in inequality and unemployment had an impact on people incentives to illegal behavior. The deterioration of these indicators should have resulted in higher attractiveness of involvement in the illegal sector, even if it is becoming more risky. Probably, the influence of those indicators was different for major types of crime. Thus, we are going to consider two types of crime, homicide and larceny-thefts, as representatives of violent and property crimes. The second hypothesis we are going to test

is that the efficiency of the law enforcement agencies also impact on the crime rate. Is there sufficient control of the state over the crime situation? Does the probability to be detected deter a criminal? Another question that may be raised in this project is whether economic and social instruments rather than law enforcement can prevent people from crime. As is recognized in other countries, for example, greater employment opportunities, training at school or institutions of higher learning keep youth from illegal activities.

Looking at crime distribution across the Russian regions, one can notice that there are stable differences among the regions. Crime increases from west to east and the pattern (not levels) is rather stable in time dimension. This can mean criminal inertia or crime persistency over time, the next hypothesis to be tested.

The main question we want to answer is "What are the main determinants of criminal behavior in Russia and what policies, law-enforcement-related and socio-economic, can be used to control or combat crime?" We will try to concentrate more on basic crime determinants (so called factors of crime) known from the empirical literature.

Data we are going to use in the project are panel data that is pooled time-series from 1990 to 1998 and cross-section data for 89 subjects of Russian Federation. Crime supply equation in dynamic form complemented with its first differenced form will be estimated as a system by General Method of Moments. Explanatory variables in the model are allowed to be endogenous. Instruments to be used are from moment conditions implied by assumption of endogeneity.

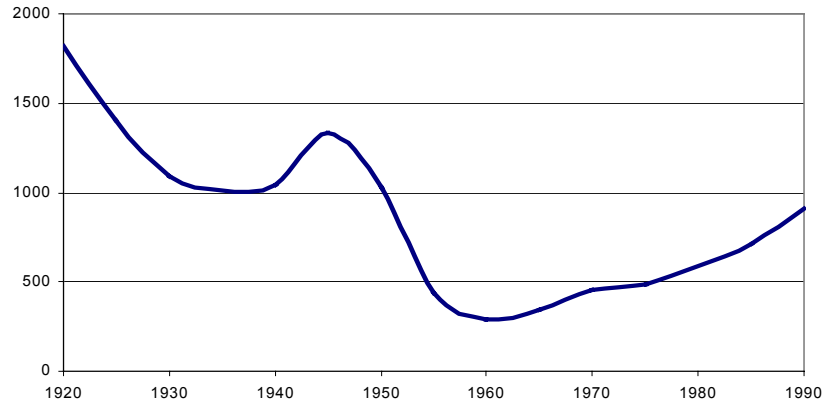
The paper consists of five main parts. The First section describes the historic development of crime in USSR and Russia, and changes occurred during transition period. The Second part contains literature review. In the Third section we present theoretical and empirical models, including methodological issues. Data and results are given in the Forth section. And the last section concludes.

I. Historic development of crime in Russia.

Crime was a problem in Russia even at the beginning of XX century. In the tsarist Russia the number of criminal cases was very big, on the level of 2.5 million, i.e. approximately the same rate as in the last decade of the XX century. The October revolution led to a dramatic economic decline and simultaneously to growth in crime. Then, as we know, under the Soviet regime the state was able to cope both with crime and

political freedom by means of cruel repression. Criminal statistics collection was established in USSR in 1922 and it reported astounding 2.9 % of population convicted in 1924, coming down to 1.7 and 1.8 in 1925 and 1926. It is noteworthy, that it is much higher than conviction rate 0.7 % of population in 1999. After Stalin's death and further political warming in the 50-s, the crime rate in USSR began to rise gradually following a worldwide trend in crime. We recognize that the largest part of crimes during Stalin's time could be not civil but rather political crimes. Downward trend on the figure below reflects, to my mind, the ability of the - in essence - police state, to keep citizens under control and to suppress freethinking with savagery. On the other hand, as Soviet Union had the boggled imagination economic growth at that time, which is usually accompanied by the rise in crime activity in a democratic society, the deterrent effect from police and repression was obviously much higher than we may think.

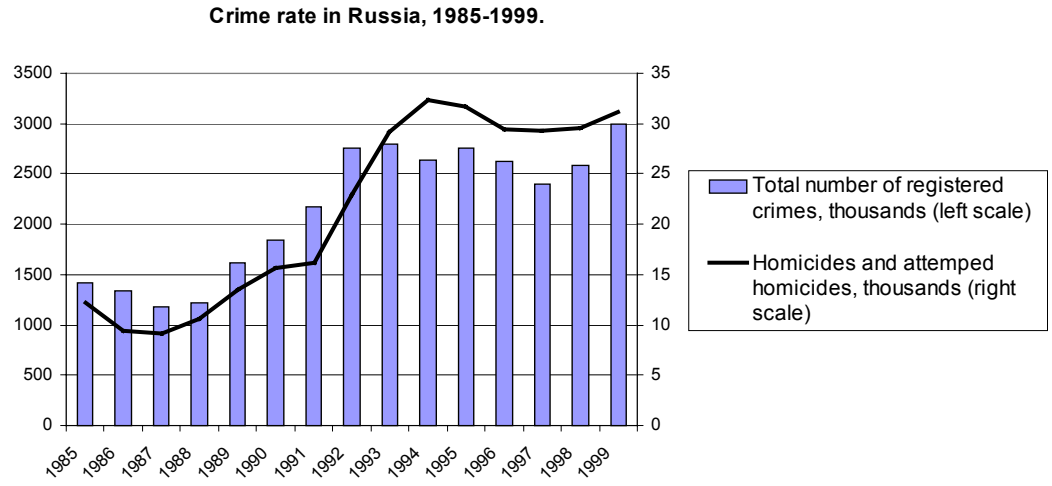
Number of crimes per 100'000 population in USSR, 1920-1990



Source: normalized figure from Kudryavtsev V. N., "Sovremennie problemi borbi s prestupnostyu v Rossii", Vestnik Rossiyskoy Akademii Nauk, vol 69, # 9, p. 790-797.

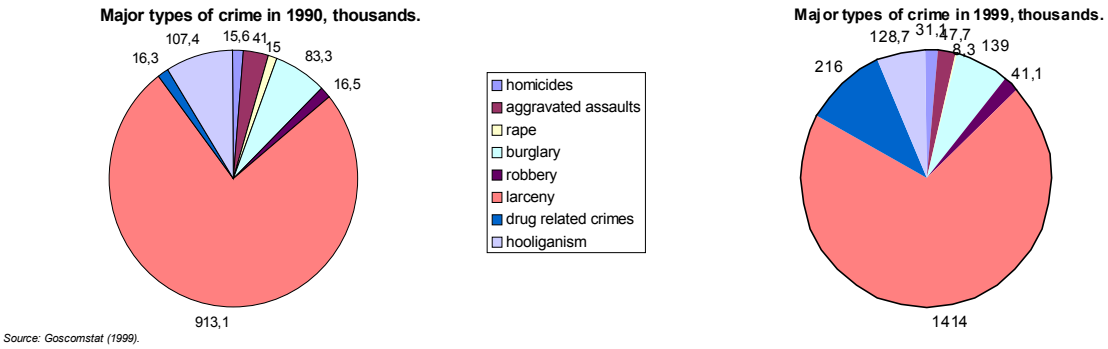
After the beginning of the democratization process in the Soviet Union or in Gorbachev's epoch in 1985 the hopes of the Russians for the end of the command economy were very high and looked realistic. The euphoria of acquired freedom in fact resulted in some improvements in the economic and the crime situation, but since 1988 irreversible processes of further democratization in political and economic life continued, which led to an incredible growth in crime rate. One of the much merit of Gorbachev's politics was opening of criminal statistics to public, which was closed for more than 50 years of the Communist regime. To our mind inability of law enforcement system to cope with increased crime was the main cause of crime wave that began at the end of 80-s. The Soviet penal system, the most severe in the world, that kept in custody about 2 million

people (0.7 % of population) in the mid of the 80-s[1], together with police force were unable to fulfill their duties after the democratic revolution in the society.



Source: Goscomstat (1999).

By the time the economic liberalization was initiated by Gaidar's cabinet at the beginning of 1992, the crime rate was already 80 % higher than in 1988 and had grown by further 30 % before it stabilized in 1993 (see figure above). The period of relative improvement in 1994-1997 in Russia was followed by a rise in crime after the 1998 crisis. And this anxious period lasted until 2000 when the crime rate goes down slightly.



Source: Goscomstat (1999).

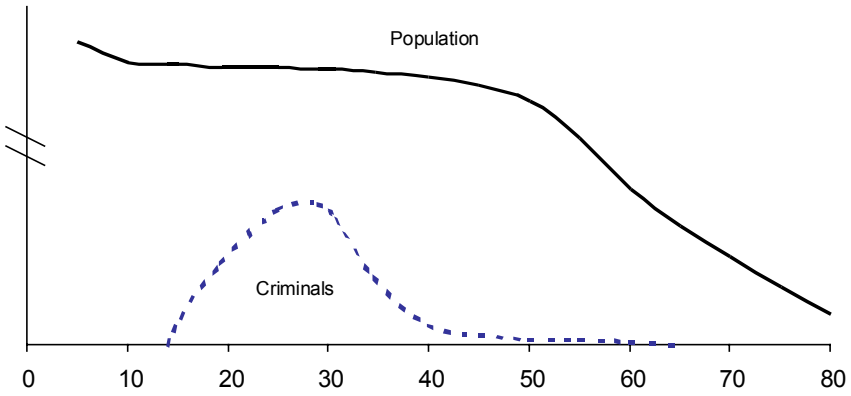
However, during the decade of transition not only the level of crime changed, but also its structure. Unsurprisingly the most spectacular increases were observed in economic and drug related crimes, with the latter increasing thirteen fold since 1990. More generally, offenders became more aggressive and violent during the 90-es. Thus, in 1993 only about 20% of all crimes were classified as serious ones, that is crimes for which -according to the Penal Code- offenders can be punished with sentence of 5 and

[1] Interestingly, the level of prison inmates and the number of population in USA in 1999 surprisingly coincide with that in USSR in the mid of 80-es.

more years of imprisonment. Alarmingly the percentage of serious crimes had jumped to 60 per cent in 1998.

Crime is very young and this is true not only for Russia. As we can see from the figure below, on average an offender in Russia is from 20 to 33 years of age.

Age profiles of criminals and population in Russia



Source: Kudryavtsev V. N., "Sovremennie problemi borbi s prestupnost'u v Rossii", Vestnik Rossiyskoy akademii nauk, vol 69, # 9, p. 790-797.

Especially young people between 18 and 24 became more involved in illegal activity. The share of detected crimes committed by this age group rose from 21 to 26 % between 1990 and 1998, and -even more alarmingly- their share in serious crimes from 22 to 29 %. Apart from youthful exuberance this seems to result from the fact that young people (and more generally families with children) are relatively poor, as they are worse paid in the legal sector than their more senior colleagues. In this regard demographic disaster that occurred in Russia during 90-es will doubtless result in better crime situation in 20-30 years. But pretty soon we should expect negative consequences of the Russian baby boom in the first half of 80-es.

Contrary to common perception, by far the largest part of homicides in Russia are unconnected to business or politics, but is simply due to escalating tensions in the home and ordinary life. This is evidenced by the extremely high share of violent crimes committed under the influence of alcohol. About 80% of murderers and 60% of murder victims were drunk at the time of the crime. This role of alcohol in violent crime is also a common feature in other countries. In the US, for example, about 60% of all persons convicted of assault had been drinking prior to the crime and in Sweden about a half of murderers and their victims were intoxicated during the attack (Markowitz, 2000). Nevertheless, Russia seems to be in a league of its own, and the importance of alcohol in explaining violence cannot be underestimated.

In spite of this negative development in crime activity during transition period, Russia still has the crime rate below the level in many Western European countries even if we take into account the higher rate of not registered crimes in Russia. On the other hand, the homicide rate in Russia is four-five times higher than in other European countries and approximately at the same level as the homicide rate in USA and Brazil. It should be noticed that the high homicide rate in Russia corresponds to other high mortality rates, like the suicide rate, which is four times as much as in Europe, and even the general mortality rate. The latter was equal to the European average mortality rate in 1990, about 10 deaths per 1000 population but after five years it was already 50 % higher than the European average and achieved the level of 14 deaths per 1000 population. It is also interesting that suicides, homicides and health problems are particularly prevalent in rural areas. This, together with the fact that most violent crimes occur in the home or immediate neighborhood, suggests to us that a large part of crimes in Russia is a direct consequence of hardships associated with a decade of economic decline and epochal changes. This in turn suggests that the problem is temporary, but positive changes will probably be slow.

Writing about crime we should not forget about law enforcement activity of the state. First, we understand that during recession the state was not able to provide adequate financing for its Criminal Justice and Police System. Thus, efficiency of Police activity, say measured by the detection rate, diminished sharply[2]. On the other hand, poor financing of courts and prisons led to more heavy punishment during transition.

Russia and USA are still on the top of the prison population rating, keeping in the custody about 0.7 per cent of population. About 1 million people are behind bars in the prisons and pre-trial detention facilities in Russia. About 20 % of them were convicted in personal crimes (homicide, rape or assault) and about 25 % committed serious property crimes (burglary and robbery). In the words of Pristavkin, the head of presidential commission on pardon, up to 90 % of incarcerated in Russia are not professional criminals as they had committed a domestic crime.

Prisons and pretrial detention facilities are overcrowded in Russia, often the density in the latter is lower than one square meter per man, and detainees have to sleep in three shifts. Convicted people held in correctional institutions are short of food, medicine and clothes. As a consequence, the risk to become ill with tuberculosis in prison is 58

[2] But not in official reports.

times higher than the Russian average, and the general mortality rate is 28 times higher. This is apparently not only due to a lack of resources, but to some degree a conscious policy of the Russian penal system. Ministry of Interior officials say that they prefer to keep young men in pretrial detention facilities for as long as possible even for small delinquencies to show them the whole unattractiveness of being in such a place[3]. An unprecedented amnesty in the summer 2000, when about 100,000 people should have been released from prisons[4], did little to improve the situation of those remaining in custody.

Penal system in Russia, which was inherited from the command regime and continues to be one of the most severe in the world, needs to be reformed in the direction of providing population with further democratic freedoms.

II. Literature review.

As Latov writes in his review (Latov, 2000), American economists retain intellectual prevalence in economic-criminological studies. Western European studies play the secondary role. Say, Entorf (Entorf, 1997) express regret for absence of modern research in Economics of crime in Germany. There are few empirical studies of crime in Russia, if any. Unfortunately, Russian economists and other scientists have not played their role in studying this vital problem yet. In the words of Latov this paper will be the first empirical study in Economics of crime in Russia.

Economic models of crime with expected utility maximization approach have been developed since Becker's seminal paper (Becker, 1968), in which he proposed a simple cost-benefit analysis incorporating monetary gains and losses and uncertainty about the punishment for an illegal activity. The main result of the model is that the probability of punishment and monetized size of punishment deter an offender that is with their increase the expected utility reduces. Moreover, an offender with decreasing absolute risk aversion is more deterred by 1 % increase in the probability in punishment rather than the same rise in the size of punishment. Also, Becker considers a supply of offence function of the entire society, where total number of crimes is a function of the average values of the probability, severity of punishment and other factors.

[3] Suspect people usually spend periods between six months and two years in such facilities before they are remanded for trial.
[4] But were not released by the beginning of fall yet, as far as we know.

Another theoretical model is a portfolio choice model of crime (presented, e.g. by Heineke, 1978), where an individual decides what proportion of his exogenous income to allocate to an illegal activity with an uncertain outcome. He proves that the probability and the severity of punishment deter crime for a risk averse person.

The third type of models suggested in Economics of crime is a portfolio model of time allocation between legal and illegal activities. For example, Ehrlich (1973) considered a model with fixed leisure time.

The conclusions of all mentioned models are quite similar. Thus, assuming decreasing absolute risk aversion, all models provide the same conclusions about deterrent effect of a rise in the probability and severity of punishment and about an impact of increased wealth and gains from both legal and illegal activities on the crime rate rise.

What empirical papers estimate is usually a simple crime supply function or that with a production function of law enforcement activity, using OLS and 2SLS methods respectively. Both methods usually provide similar results. As stated in Eide (1994): in spite of a possible spurious correlation between clear-ups ratio and crime rate, both estimations of the impact of probability of punishment on crime rate are negative, but OLS is usually two times lower in absolute value than 2SLS.

Norwegian economist Eide (1994) reviewed a sizable number of empirical papers in which authors usually estimate a cross-section regression for cities, districts, or states, and in particular reported that

(i) The probability and the size of punishment (e.g. arrest ratio and average prison term) have a significant negative effect on all types of crime (Ehrlich, 1973; Vandaele, 1978; Myers, 1980; Mathur, 1978; Avio and Clark, 1978), however, in a few studies the effect of severity of punishment is not significant.

(ii) Different measures of benefits from legal activities like mean or median income usually provide significant negative effect on crime (e.g. Myers 1980; Mathur 1978; Mathieson and Passell 1976; Heineje 1978) but some of the studies do not reject significant positive impact (Sjoquist 1973; Willis 1983). Given those results, total effect of legal income opportunities is ambiguous as it represents not only costs but also gains to an offender.

(iii) A little bit vague conclusion holds also for income inequality, which is positive in most of the significant cases (Ehrlich 1973; Vandaele 1978; Swimmer 1974; Holtman and Yap 1978) but Mathur (1978) reported that Gini coefficient has a positive and negative impact on murder and robbery (or burglary) accordingly.

(iv) Unemployment is found empirically to be indefinite in its relations with crime, e.g., significantly positive in (Thaler 1977; Willis 1983).

(v) Among other indicators included in studies as explanatory variables, some important demographic indicators deserve to be mentioned. Thus, population density has a positive effect in all significant cases (Willis 1983; Forst 1976; Danziger and Wheeler 1975), age represented by the proportion of the youth is also significantly positive (Avio and Clark 1978; Schuller 1986), race measured as proportion of non-whites (in US cities or states) is almost always has a strong positive impact (Ehrlich 1973; Vandaele 1978; Danziger and Wheeler 1975).

Panel data estimation was quite scarce in Economics of crime studies compared to the above cross-section and time-series studies. Although, panel data cause some estimation problems, they provide a better model specification and combine both time and space in one estimation.

Levitt (1997) using a panel of large US cities from 1970-1992 and exploring original instruments first demonstrated that police reduce crime. In another paper of him on the same panel Levitt (1995) showed that the presence of measurement errors, that is crime underreporting, do not change the observed negative relation between the arrest and crime rates.

Fajnzylber et al (1998) in their multinational study of 34 countries for 1970-1994 using GMM system estimation have found that income inequality increases crime, that crime is counter-cyclical, persistent over time and deterred by higher conviction rate and police personnel. The same authors (Fajnzylber et al, 1999) using an enlarged pooled sample for 45 countries over the 1965-1995 period have concluded that income inequality, measured by Gini coefficient, has a significant positive effect on homicide and this fact cannot be explained by poverty, education inequality, unfair distribution of police and justice protection.

Entorf and Spengler (1998) have estimated supply-of-offences functions for different crime categories using panel data of the German regions. The results confirm deterrence hypothesis for crime against property, but only weakly for crime against person. They use economic variables as measures of legal and illegal income opportunities. Thus, higher income and income inequality are found to be associated with higher crime rates.

There are a few empirical papers estimating impact of alcohol consumption on mainly violent crimes. For example, it was shown in Lenke (1975) that there is a

statistical correlation between the violent crime rate and alcohol consumption per capita in some Scandinavian countries in 1960-1973. In a recent paper Markowitz (2000) using the results of victimization surveys held in 16 developed countries, has found that higher price for alcohol beverages reduces violent crime.

All in all, a set of different socio-economic-demographic and law enforcement indicators is used in the empirical literature with a purpose to show their impact on crime activity, but sometimes there is only weak explanation of their relationship with crime and as a result different conclusions are observed. So, we still do not know all main causes of illegal behavior. Therefore, more in-depth studies are needed in this field.

III. Models and methodology.

III.i. Theoretical and econometric models.

We proceed here with a simple model similar to that of Fajnzylber et al (1998). Assume a risk neutral, rational economic agent who decides to commit a crime if net benefits

$$r=(1-p)*B-C-I-p*F \quad (1)$$

are above the threshold m, where p is probability of punishment, B is loot, C is costs of planning and executing the crime, I is income from legal activity, F is the size of punishment. Assume the probability of committing a crime is a function of two arguments

$$Prob=\Phi(r,m), \quad (2)$$

where Φ is an increasing and concave function of net benefits: $\Phi_r'>0$, $\Phi_{rr}''<0$, and a decreasing and convex function of threshold level: $\Phi_m'<0$, $\Phi_{mm}''>0$.

Further we present a discussion on how different socio-economic variables affect the parameters in the model. A higher individual's income ($I\uparrow$) is perceived as opportunity cost to crime execution as an offender can earn money in the legal sector and leads to lower net benefits ($r\downarrow$) and probability of committing a crime ($Prob\downarrow$). But higher income of a victim means higher loot ($B\uparrow$) (unless the richer are better protected against a crime), so a total effect of income is unclear. Higher inequality in income distribution could mean higher tension and more conflicts in community groups and may lead to a fall in threshold level ($m\downarrow$) (lessens the norms and increases wants) for a poor individual, thereby increasing a chance of committing a crime ($Prob\uparrow$).

Better law enforcement activity is either higher probability of detection an offender p or the higher size of punishment F, which are substitutes in terms of the model in the sense that one per cent increase of any leads to the same expected size of punishment $p*F$. One per cent increase in p is probably more costly to society, than one per cent rise in F, but as many researches claim deterrent effect from the size is often less than that from the probability (see for example, Becker 1995). So, society may gain more from an increased probability of being punished, if it is not much more costly than simply increasing the size of imprisonment[5].

Alcohol can be used by criminals to master courage (or to repress fear). Heavy alcohol drinking could lead to irrational behavior of a person, when he/she inadequately appreciates the consequences of proceedings. One may think, anyway, that higher alcohol consumption leads in terms of our model to lower threshold level ($m\downarrow$) through lower individual's norms. The same impact on threshold level is expected to be for drug users. Moreover, drug addiction needs more spending compared with intemperance in drink and hence drug users may accept more risky criminal projects, e.g. burglary instead of theft.

Educational level has an ambiguous effect on crime decision. On the one hand, a better-educated person may obtain higher loot ($B\uparrow$) and spend less on crime execution ($C\downarrow$). On the other hand, a better education might lead to higher threshold (norms) ($m\uparrow$) and gives more opportunities in the legal sector with a higher income ($I\uparrow$).

Past experience in criminal activities is another important factor affecting the decision to remain in this sector through lower costs ($C\downarrow$), higher loot ($B\uparrow$) and reduction in the level of legal income ($I\downarrow$), opportunity cost to be in the criminal sector or in jail[6]. In general, higher incidence of criminal activity facilitates a transfer of experience to young generation.

The income of the unemployed or those who do not have permanent source of income, such as unemployment benefits, is negligible. So, they have higher net benefits ($r\uparrow$). Moreover, a desperate person is more prone to crime.

We know that people in cities usually have higher income ($I\uparrow$) and also loot ($B\uparrow$), since there are more opportunities to work but also to steal. Also, there is a greater interaction among people in the cities (and therefore, more conflicts) and offender has

[5] That is the length of time served, which is very costly for our budget as we can see how poorly prisons are financed in Russia.
[6] Those who have criminal records, have less opportunity to find a legal job.

expectation of a lower probability of being detected. The total effect of urbanization is unclear and may depend on various factors.

Described relations between parameters of the model and some social-economic and demographic (SED) indicators are summarized in the table below.

Table of relations.

	Enforce-ment	**Criminal experience**	**Alcohol, Drug**	**Income**	**Inequa-lity**	**Educa-tion**	**Unemploy-ment**
Prob. of punishment	+						
Loot				+	+	+	
Costs		-				-	
Income		-		+		+	-
Fine	+						
Net benefits	-	+		?	+	?	+
Threshold		-	-	+		+	
Prob. of committing a crime	-	+	+	?	+	?	+

The next step is a transformation of the theoretical model into an empirical one allowing its estimation on the aggregate data set. The RHS of the expression for net benefits *r* is a function of the set of indicators

r=r(criminal experience, probability of apprehension, strength of sentence, alcohol and drug consumption, income, income group, family conditions, residence (urban or rural), educational level, ethnic group, age, etc.) (3)

In the same way we can write the expression for the threshold level

m=m(criminal experience, alcohol and drug consumption, income, income group, family conditions, residence (urban or rural), educational level, ethnic group, age, etc.) (4)

Assuming a linear form of functions Φ, *r* and *m* in (2)-(4), and aggregating the equation for regional population, we obtain the linear crime supply equation for crime rate

$$Crime_{it} = \beta_0 * Crime_{it-1} + \beta_1 * P_{it} + \beta_2 * Alcohol_{it} + \beta_3 * Drug_{it} + \beta_4 * Education_{it} +$$

$$\beta_5 * Income_{it} + \beta_6 * Gini_{it} + \beta_7 * Unempl_{it} + \delta * X_{it} + \gamma_t + \alpha_i + \varepsilon_{it}, \quad (5)$$

where subscripts 'i' and 't' are a region and a year respectively; $Crime_{it}$ is a crime rate; P_{it} is a probability of punishment; $Alcohol_{it}$ is a measure of alcohol consumption; $Drug_{it}$ is a measure of drug consumption or the number of drug users; $Income_{it}$ is an average real income; $Gini_{it}$ is a Gini coefficient, a measure of inequality in income distribution; $Unempl_{it}$ is an unemployment rate; X_{it} is a matrix of other socio-economic, demographic, and other indicators usually included in the crime supply function to control for (observed) differences in regional performance, which may reflect norms and wants in those regions (family disruption, share of urban population, ethnic structure, age structure, geographical location, etc.); α_i is a regional specific constant term which includes other (unobserved) characteristics of a region; γ_t is a year dummy (unobserved changes of crime rate in time); ε_{it} is an error term.

Note that criminal experience is measured as lagged crime rate and reflects both the number of criminals in the region and their intensity of crime committing. The term of a sentence is not included in the model as an independent variable, as we believe that it does not vary across regions and over time in spite of the new Criminal Code introduction in 1997[7], but this problem needs further investigation. Unfortunately, we do not have any regional data on that at the moment.

III.ii. Methodology.

Some objections to the empirical studies of crime usually come from measurement errors in reported crime. Thus, latent (unregistered) crime rate in Russia can vary from 20 to 99 % and even more for different types of crime[8]. However, the most serious crimes are better reported[9]. Victimization surveys usually provide more reliable information about the actual crime level. Studies based on them show that results do not markedly differ from studies using registered crime rate[10]. Levitt (1995) used Griliches and Hausman (1986) technique to show that measurement error does not change conclusions for deterrence effect in US.

[7] A judge from Khabarovsk krai told me in private interview in winter 2000 that even if new Code allows more severe sentence, judges rarely apply it and continue to use the same sentences for similar crimes as they are used to do.

[8] In USA only 38 % of all crimes are reported to police (Levitt 1995), while in Russia that figure is much lower, about 1/5 of all crimes are registered, including 1/3 of homicides, 1/7 of rapes, 1/78 of larceny cases (Kudryavtsev 1999).

[9] E.g. Moscow police registers about 25 % of all crimes committed in the city, predominantly those that they may expect to solve (Sinelschikov 1998).

[10] E.g. Myers showed that elasticities of punishment variables do not differ more than 5 to 15 % between actual and reported crime rates, as cited in Eide (1994, p.169).

Another way of dealing with a problem of underreporting was presented by Fajnzylber et al 1999. Following their idea, assume that true crime rate is a sum of registered crime rate and regional specific (constant over time) effect:

$$Crime_{it}=Crime'_{it}+\nu_i \quad (6)$$

Obviously, if we now substitute observed crime rate for actual crime rate in (4), then the model looks as follows

$$Crime'_{it}=\beta_0*Crime'_{it-1}+\beta_1*P_{it}+\beta_2*Alcohol_{it}+\beta_3*Drug_{it}+\beta_4*Education+$$

$$\beta_{5*}Income_{it}+\beta_6*Gini_{it}+\beta_7*Unempl_{it}+\delta*X_{it}+\gamma_t+[\alpha_i-(1-\beta_0)*\nu_i]+\varepsilon_{it}, \quad (7)$$

which exactly coincides with the model for actual crime rate in (5).

Another important methodological issue concerns the data. Is it acceptable to study such a problem on an aggregate data set? As it often occurs we would prefer individual data, but they are rare by contrast to the aggregate level data. The conclusions based on this approach are not looking too inferior compared to individual approach and usually are very similar (see e.g. Witte and Tauchen, 1994), but unfortunately do not reflect those individual differences, which may affect personal behavior. Anyway, aggregate data set is a good start for empirical work.

The model we have estimated first has a serially correlated error term and has not a dynamic component. The former is an indicator that some important independent variables are omitted. Therefore, the dynamic model in which lagged crime rate is included as regressor could be used. For its estimation some authors (Greene, 1997; Fajnzylber et al, 1998) recommend to use either a level regression or a system in levels and first differences, both is to be estimated by using General Method of Moments (GMM) with some relevant moment conditions.

Instead of usual assumption of strictly exogenous regressors this approach allow us to assume that some RHS variables could be weakly exogenous. This means they could be affected by past and present realizations of dependent variable but not by its future values.

In this project we are going to use a program written in Gauss computing GMM estimation for panel data. We rely on methodology and the program description in the paper Arellano and Bond (1998).

The theory behind the dynamic model estimation is presented in brief below.

Consider an AR(1) model of panel data in general view:

$$Y_{it}=\alpha Y_{it-1}+\beta' X_{it}+\gamma_t+\eta_i+\varepsilon_{it} \; i=1,\ldots,N; \; t=1,\ldots,T; \; N>T \quad (8)$$

A transformation (the first difference or orthogonal deviation) of this model is applied in order to eliminate unobservable individual effect η_i. We will use the first difference of the equation (8):

$$\Delta Y_{it}=\alpha\Delta Y_{it-1}+\beta'\Delta X_{it}+\Delta\gamma_t+\Delta\varepsilon_{it}\ i=1,\ldots,N;\ t=2,\ldots,T;\ N>T \qquad (9)$$

where $\Delta Y_{it}=Y_{it}-Y_{it-1}$, $\Delta X_{it}=X_{it}-X_{it-1}$ and so on..

If we assume, first, error term ε_{it} is not serially correlated, and, second, explanatory variables are weakly exogenous, that is their current realization can be determined only by past and current values of dependent variable, then the following moment conditions can be used in GMM estimation:

$$E[Y_{it-s}(\gamma_t+\varepsilon_{it})]=0 \text{ for } s\geq 1,\ t=2,\ldots,T \qquad (10)$$

$$E[X_{it-s}(\gamma_t+\varepsilon_{it})]=0 \text{ for } s\geq 1,\ t=2,\ldots,T \qquad (11)$$

As follows from both these conditions, $E[Y_{it-s}(\Delta\gamma_t+\Delta\varepsilon_{it})]=0$ for $s\geq 2$, $t=3,\ldots,T$ and $E[X_{it-s}(\Delta\gamma_t+\Delta\varepsilon_{it})]=0$ for $s\geq 2$, $t=3,\ldots,T$ which allows us to use second and higher lags of dependent and weakly exogenous independent variables as instruments for the regression in first differences.

Usually the regression in first differences (8) is complemented by the regression in levels (9) as difference estimator has low asymptotic precision and large biases in small samples. The instruments to be used for the regression in levels should not be correlated with the individual effect η_i. Assuming stationary property of the model (7), that is $E[Y_{it}\eta_i]=E[Y_{is}\eta_i]$ and $E[X_{it}\eta_i]=E[X_{is}\eta_i]$ for $t=1,\ldots,T$; $s=1,\ldots,T$ we will have additional moment conditions:

$$E[\Delta Y_{it-1}(\gamma_t+\eta_i+\varepsilon_{it})]=0 \text{ for } t=3,\ldots,T \qquad (12)$$

$$E[\Delta X_{it-1}(\gamma_t+\eta_i+\varepsilon_{it})]=0 \text{ for } t=3,\ldots,T \qquad (13)$$

We see that lagged first differences of dependent and endogenous independent variables could be used as instruments for the regression in levels, but further lags would be redundant in the system estimation as lagged levels are already included as instruments for the regression in first differences.

According Arellano and Bond (1991) GMM provide the next estimates for the system of regressions (8) and (9) with moment conditions (10)-(13):

$$\hat{\theta}=\left(\overline{X}'Z\hat{\Omega}^{-1}Z'\overline{X}\right)^{-1}\overline{X}'Z\hat{\Omega}^{-1}Z'\overline{y} \qquad (14)$$

$$\text{Avar}\left(\hat{\theta}\right)=\left(\overline{X}'Z\hat{\Omega}^{-1}Z'\overline{X}\right)^{-1} \qquad (15)$$

where $\theta = (\alpha, \beta)$, $\bar{X} = (y_{t-1}, X)$, $\bar{y} = (\Delta Y, Y)$, Z is a special matrix constructed from instruments, and $\hat{\Omega}$ is a consistent estimate of variance-covariance matrix of the moment conditions.

Crucial assumption for the consistency of estimators is no serial correlation of error term ε_{it}. If it is not serially correlated, then its first difference $\varepsilon_{it}-\varepsilon_{it-1}$ should be negatively first order serially correlated but not second order serially correlated. Formally, $Corr(\varepsilon_{it}-\varepsilon_{it-1},\varepsilon_{it-1}-\varepsilon_{it-2})=-\sigma_i^2$ and $Corr(\varepsilon_{it}-\varepsilon_{it-1},\varepsilon_{it-2}-\varepsilon_{it-3})=0$ if we assume $Corr(\varepsilon_{it},\varepsilon_{it-1})=0$ and $Corr(\varepsilon_{it},\varepsilon_{it})= \sigma_i^2$.

If the null hypothesis of no second order serial correlation is rejected then higher order lags of dependent and endogenous independent variables should be used as instruments. Another test in the model is a Sargan test of overidentifying restrictions, which tests the validity of instruments. Not rejected null hypothesis supports the estimated model.

Now we are ready to proceed further with econometric estimation of the model.

IV. Empirical part.

Note that in the theoretical framework we do not make any assumption on the type of illegal activity. We think that the model is equally suited for both violent and property crimes. In the former case, as it is often done in the neoclassic economic approach, we assume that there are some psychic costs and gains from violent activity, which can be evaluated in monetary terms. This approach is fruitful even in such a case, as we will see later. The model (7) derived in the theoretical part will be estimated for both violent (or personal) and property crimes. Though criminologists may object to this approach and call different causes for each particular type of crime, we believe that we are using factors common for either crime activity. Also, this approach allows us to assess the possible substitution effect between two types of crime.

Violent crimes in Russian juridical literature include the four types of crime, namely homicide, assault, rape, and hooliganism. The number of homicides and attempted homicides will be used as a proxy for violent crime rate[11]. According to criminologists, this indicator has the highest quality as it better reported by police. On the contrary, the number of larceny-thefts, which we are using as a proxy for property crime rate suffers

[11] They total about 15 % of all violent crimes in Russia.

from underreporting[12] though it presents the largest part of property crimes[13]. The most frequent types of crimes against property are larceny-theft, burglary, robbery, fraud, and auto-theft.

IV.i. Data.

Descriptive statistics and definition of variables are presented in Tables 1 and 2 in Appendix. Note that economic indicators have quite large standard deviations. It is not strange inasmuch as moderate differences in initial conditions and further economic crises and divergence of the Russian regions.

Crime levels and clear-up ratios both for homicide and larceny for all 89 regions in 1990-1998 were provided by the Main Information Center of the Russian Federation Ministry of the Interior in which all statistics about crime in the country are collected. A regional map of homicide rate per 100'000 population in 1998 can be found in Appendix, Figure 1. Some shortcomings of official crime levels were already discussed above.

Alcohol consumption figures are not available for regions and even for Russia as a whole. We know, however, official and shadow production of vodka, which total about 7 litters of pure alcohol per capita in 1999 (Goscomstat, 2000)[14]. Following the recommendations of an expert[15], the best available proxy for alcohol consumption could be the number of people hospitalized in stationary medical facilities with alcoholic psychosis, and to some extent a mortality rate from alcohol poisoning[16]. The former was obtained from the Institute of Narcology for 80 regions over the period of 1990-1998 and the latter is from the Institute of Psychiatry for 89 regions over the period of 1991-1998. Unfortunately, none of the above alcohol indicators reflect the picture of alcohol consumption accurately, especially in rural areas, where men are usually heavy drinkers and are not treated for alcoholism. The national homicide and alcohol psychosis rates are shown on Figure 2 in Appendix.

[12] About 80 % of them are not reported and not registered by police.
[13] About three fourth of all property crimes.
[14] Nevertheless, different estimates of alcohol consumption in Russia at the end of 90-es show the level of about 14 liters of absolute alcohol per capita a year (e.g. Izvestiya, Jan 5, 2000).
[15] Professor Nemtsov from the Institute of Psychiatry, Moscow, who is an author of papers on alcohol addiction issues.
[16] Simply because they are better reported and reflect more or less plausibly the share of people who heavily consume alcohol drinks. But alcohol-poisoning mortality is looking inferior proxy to alcohol psychosis as it reflects quality rather than quantity of consumed beverages.

Drug consumption was approximated by the number of people with diagnosed drug addiction, which was also obtained from the Institute of Narcology for all Russian

regions during the period 1991-1998. Although the real number of drug users is not less than ten times as much as this official statistics reports[17], we hope that data correctly reflect dynamics and differences among the regions, i.e. we assume that proportion of registered drug users is somehow stable over time but different only for each region. Data for 1990 was extrapolated.

Real income is calculated at constant prices of 1990. Nominal income per capita for 1990-1993 was obtained from Goscomstat (1999). Average annual CPI for 1991 and 1992 obtained from Goscomstat (1994) and 1993 obtained from the RECEP database were used as price deflators. Real income per capita for the other years was calculated from real income growth for 1994-1998 taken from Goscomstat (1999). These figures are available only for 70 Russian regions.

The Gini coefficient for 1994-1998 was produced by the author's calculations based on data from Goscomstat (1999). Assuming lognormal distribution of income in the regions and implementing the two-factor model, the coefficient was calculated based on the subsistence level, average income and the share of population with income below the subsistence level. For the other years coefficient was extrapolated, assuming that income inequality was not greater in 1990-1993 than it in 1994.

The level of education is again the author's calculations of average years of schooling of population above fifteen years of age. Distribution of population by educational level is from Micro census (1995). Figures for the other years were propagated. The share of indigenous population in the region representing ethnic structure in this study was obtained from the last census of population (Census, 1989) and it is also constructed to be stable over time.

Other demographic indicators, a share of urban and a share of young population (below 16 years of age) in a region for 1990-1998 (Goscomstat, 1999) could be the important demographic variables. The indicators of geographical location of the region are presented by the latitude and longitude of the regional center. They are another pair of constant in time indicators.

Family disruption in our paper is measured by the difference between the number of marriages and divorces in a region (Goscomstat, 1999).

[17] Official number of people with diagnosis of drug addiction was 155 thousand while narcology specialists estimate the real number of drug users is over 3 million people.

The number of unemployed people is taken from Goscomstat annual labor force survey (Goscomstat 1999), which is conducted regularly since 1992 and uses a standard ILO classification. Data for proceeding years were obtained by extrapolation.

IV.ii. Regression results.

Regressions were run in the program DPD98 written by mentioned above Arellano and Bond (1998), which was kindly provided by Hartmut Lehmann. In Table 4 in Appendix we report the results of three regressions, first for homicide rate and then for larceny-theft. The table presents average elasticities of the crime rate with respect to independent variable. Elasticities were calculated from the obtained coefficient estimators multiplied by the ratio of dependent and independent variable means. Definitions of variables and their descriptive statistics can be found in Tables 1 and 2 respectively.

The OLS estimators of model (7) without dynamic term, i.e. when lagged crime rate is not included as explanatory variable, are not valid since test for no first-order serial correlation is rejected and therefore they are not reported in Table 4.

First column is a simple OLS estimation of the model (7). The second is GMM estimation of the regression in levels, i.e. the model (7) with the list of instruments, which includes second lag of crime rate and first lags of weakly exogenous explanatory variables. The third is a system GMM estimation of the regression (7) and its first difference with lagged differences and second lags of levels used as instruments for the equations in levels and first differences respectively. Here we use two-step procedure to obtain efficient and consistent estimates, which explores residuals from the first step to construct the consistent estimate of variance-covariance matrix.

Sargan test of overidentifying restrictions under the null hypothesis of the validity of instruments is not rejected for all four GMM estimations. The disturbances from all three regressions for homicide and the third regression for larceny-theft are not serially correlated as the test for no first-order serial correlation of differenced residuals is rejected and test for no second-order serial correlation is not rejected. OLS and GMM level regressions for larceny-theft are not valid, as they have autocorrelated residuals what probably reflects that there are some important omitted variables.

We are going to ground our conclusions on GMM system estimation since it is more efficient and controls for likely endogeneity of explanatory variables. However,

from Table 4 we can conclude that all three valid regressions for homicide show striking similarity in results, with only some exceptions for homicide regressions.

Note that we have observation for transition period from 1990 to 1998 and sample period for GMM includes 7 last years for homicide system of regressions and 6 years for case of larceny-theft, whereas 2 first years are used as instruments. Also, another assumptions for consistency of estimation, that N is greater than T (70>9) and N is (asymptotically) large, are satisfied.

We can conclude that both homicide and larceny rates are persistent over time. The lagged dependent variable, which is a proxy for criminal experience is very significantly positive. Its elasticity is equal to 0.66 in case of homicide and 0.86 for larceny-theft. As we could predict thieves are more likely to repeat an offence than murderers and this is reflected in larger elasticity. Therefore, we can expect that homicides are more closely connected with other indicators. Although the interpretation of the past crime level as criminal experience could be restricted and in reality it is more complex, we think, it already contains all other information, that is accommodated to changes in its determinants.

The strength of Police, measured by the proportion of solved crimes (detection rate) is significantly negative in both cases. A higher share of cleared crimes may have two effects. The first one is a so-called incapacitation effect when criminals in custody are not able to continue their criminal activities (among freeside people) while they are in jail, thereby decreasing the number of offenders who are free. The second is a deterrence effect, which means that a higher probability of not getting away with a crime is preventing some people (criminals or not) from getting involved in crime industry. Since most studies show a negligible size of incapacitation effect, further we will refer to clear-up ratio as a deterrent effect of Police on crime. Therefore, the deterrent effect arising from police activity is found to be playing the essential role in determination of current incidence of any crime activity. This indicates the importance of this factor despite its imperfection in measuring on the first glance, given the large share of not registered crimes, especially for larceny-theft.

The next scope of socio-economic indicators has surprisingly opposite impact on violent and property crimes. While higher alcohol consumption increases violence, it has the opposite effect on property crimes. This confirms a statistical evidence of high share of violent crimes committed by alcohol-intoxicated people. Effect on property crime is not strange as the share of crimes committed by drunk offenders is much lower in this

case and do not exceed 20 % at the end of 90-es, while alcohol played not the last role in not less than 70 % of violent cases. As observed in developed countries, alcohol consumption is counter-cyclical in Russia, i.e. rises during economic recession. Another important cause of increased alcohol consumption was lost state monopoly on alcohol production in 1992 and as a consequence, low price and abundance of low quality counterfeit alcohol, which led to sharp rise in alcohol consumption entailing a higher rate of fatal alcohol poisoning. Fortunately, from 1995 alcohol consumption was declining at least up to the crisis in August 1998, following which it seems to be rising again[18]. Besides the number of alcohol psychosis we tried mortality rate from alcohol poisoning as another proxy for alcohol consumption. In this case alcohol continue to have significant increasing effect on homicides. At the same time, higher drug consumption significantly raises either types of crime. In spite of this finding, the Ministry of Interior statistics reports still very low but rising share of crimes committed under the influence of drug, which may reflect the fact that a narcotist usually commit a crime before drug usage in contrast to offenders who prefer alcohol. The close relationship between drug consumption and property crime is expected given that drugs are very expensive and a typical drug user is a relatively poor young person[19].

Poverty is another important factor of crime. According to the regression results, the rise in real income causes the fall in violent activity of criminals and the rise in acquisitive crime. A negative income effect on crime was clearly observable after the 1998 crisis when real income suddenly fell drastically by 30 %, which was followed by an approximately 25 % rise in crime rate during the next year. That year saw also an especially strong rise in larceny-theft, about 34 %, what is not corresponding to our results and probably was connected not with income but rather with other reasons like increased number of crimes committed by a theft or sudden rise in reporting rate.

On the other hand, we can conclude that higher income inequality measured by Gini index leads to higher violence[20] but have no significant effect on thefts. Meanwhile, income inequality is a measure of social tension in the society. More tension means more conflicts in social groups, including family, and hence more violence.

People who are unemployed, especially for a long time and with low chances to find a job are thought to be more prone to illegal activities due to low opportunity costs,

[18] Undoubtedly this is a feature of Russian crises.
[19] Say, the doze of heroin in Moscow is about five times as expensive as a bottle of vodka.
[20] What other researchers observe in different countries.

that is legal earnings. The Ministry of Justice statistics report that during transition the share of convicted people without a permanent source of income rose from 16 to 55 %. But does this mean that criminals constitute the largest part among unemployed? Probably not because criminals are usually young people without working experience and with low chances to find a legal job with comparable income. Therefore, they are not in the labor force. While the results of studies in other countries do not show a clear relationship between crime and unemployment, some evidence of a positive relationship exists. Our results show that unemployment rise is associated with lower violence but higher property crime cases.

Educational level is measured as average years of schooling of people above 15 years of age according to the Micro Census 1994. An impact of education on crime is recognized as ambiguous in the economic literature. It may cause some opposite effects. On the one hand, a higher level of education might indicate higher moral norms and greater job opportunities resulting in higher income in the legal economy. On the other hand, such people may be even smarter and more productive in some types of illegal activities and therefore, have higher gains from that. Regression results support the first idea, showing strong significant negative impact of educational attainment on both types of crime. Have people in a region on average one additional year of schooling, either crime rates will be about 8-11 per cent lower. Possibly reporting rate will be higher in this case thereby increasing even more the found effect of education on crime.

Concerning demographical indicators, urbanization of a region is better for property crime that is the more urban a region the less registered crime rates. Note that in a simple correlation analysis crime rate is higher in more urban areas, the picture exactly observed in other countries, e.g. in USA. From the correlation matrix in Tables 5 and 6 in Appendix we see that for homicide rate significantly negatively correlated indicators are clear-up and net marriage, and for larceny – clear-up, Gini index, net marriage and ethnic structure.

Another demographic indicator, presenting age structure is differently signed. Regions with larger share of young population suffer from higher violence but gain from lower property crimes. This conclusion is correspondent with mentioned above age structure of people convicted in crime.

Geographical and demographical indicators are also significant in the GMM regressions. As it looks on the map of Russian regions in Appendix, where homicide rate is increasing from west to east and from south to north, the regressions provide the same

conclusion. Namely, after controlling for crime experience, the strength of police and the set of socio-economic-demographic indicators, latitude and longitude continue to be significantly positive for homicide rate, reflecting other unobserved or not controlling differences among the regions (like climate, daytime, and possibly culture, traditions, norms, etc). But for larceny-theft both indicators are not significant. That gives support to the idea that regional differences in natural indicators like temperature and duration of nighttime could be important crime factors leading to more conflicts within family and neighborhood.

Not less interesting conclusion is that crime rates are closely related with main socio-economic indicators. More importantly, during crises when alcohol consumption and income inequality rise and real income falls we observe substitution of property crimes by violent crimes. In reality both crime rates were rising after shocks and crises in 1992 and 1998 and this was probably caused by problems with Police force financing inadequate to new conditions, what led to lower detection rate. This fact slightly hides the clearness of our findings about substitution effect. But it seems that after crisis, when violence was rising, a large part of Police resources was sent on fighting with violent offenders, thus giving more incentives to other crime activities.

Another important observation is a rather small magnitude of estimated elasticities of socio-economic indicators. Therefore, only large changes in economic conditions could be followed by considerable changes in criminal activity. This is exactly what Russia has experienced during 90-es and is also true for period of gradual crime growth during long period from 60-es to 80-es. Thus, say, twofold fall in real income is followed by only 6 per cent rise in crime rate according to our estimates.

Robustness check of obtained results was done in the following directions. First, as we already note, even if we use other estimation technique like pooled OLS and GMM in level for homicide, results are similar though inefficient. Second, we restricted data sample on the regions in the European part of Russian Federation. For this sub sample we had to narrow the list of instruments for the regression in levels as the previous set is not working and making the program to abort. However, the main conclusions do not change with the exception of real income and Gini, which lost their significance, maybe due to incorrect list of instruments. Third, we used other time periods, like 1993-1998 and 1994-1998. In these cases basic results remain the same with minor changes. Thus, for homicide only drug consumption has become significantly negative and for larceny real income and unemployment have lost their significance, what may be caused by a short

time period. And fourth, trying to cope with collinearity problems, we restricted the set of regressors on the core list, which includes criminal experience, strength of Police, alcohol and drug consumption, and three socio-economic indicators. In this case all results remain with two exceptions. First, detection rate for thefts continues to be negative but not highly significant. Second, unemployment rate becomes significantly positive for violence. As the last step in this model specification we study robustness of opposite effects on crime from income and income inequality. There is a significant positive correlation between real income and Gini coefficient, from the Table 5 it is equal 0.4. Real income was replaced by the interactive term between real income and Gini coefficient. As a result, we have found a further confirmation of increasing effect of inequality on violent crimes. But at the same time interactive term is significantly negative, implying that real income growth with unchanged income distribution leads to reduction in violence.
All checks we have made allow us to consider obtained results as being quite robust.

V. Policy implications.

Both violent and property crimes in Russia have a high degree of criminal inertia, which can be explained by correspondent level of criminal experience and its spreading. It may sound strange for usually not repeated crimes like homicides and more suited for recidivism in property crimes. Anyway, our finding tells us that there is a stable social environment, which may be called "social illness", that generates a deviant behavior of some part of population. Under stable environment we mean rather stable demographical and geographical situation, educational attainment, everything not connected directly with economic situation. This environment could from our point of view almost entirely explain differences in crime levels and long-term changes in crime situation. Say, observed fall in birthrate during 90-es leads to decreasing share of young people and therefore in less violence in couple decades. The similar positive impact is expected from higher educational level. One additional year of education decreases crime level by about 10 per cent. Economic situation should have immediate effect on crime, but this effect is found to be surprisingly very low. Other indicators closely related with economic situation, like alcohol consumption, family formation and disruption have higher order impact on crime levels. Only these indicators among studied have considerable short-term effect. Moreover, we still do not know what are other major reasons of short-term crime growth. Direct short-term effect from economic improvement unfortunately does not

show less crime activity. Say, Russia had outstanding 7 % GDP growth in 2000, while total crime rate has fallen by only 2 % at that year.

Present conditions of Russian penal system only facilitate the transfer of criminal experience to convicted or suspected young persons. Policy makers should have in mind this fact before this system will be reformed. Efficiency of law enforcement activity is very restricted and even if detection rate rises by 20 % (say from 50 to 60%), ceterus paribus, crime will fall only by 5-7 %. We have to think now what is better for the country, to finance Police and build new prisons or invest more in education and economy, or help families. The first is undoubtedly much cheaper but do not solve a problem and have miserable effect.

As for families, we would like to note here how important (not only from criminological but demographical view) to help young people to form a family and split those families, which are not able to live together. On the one hand, a family prevents young man from theft and other criminal activity. On the other hand, obstacles for divorces in unhappy families often lead to deplorable consequences, especially in those families, where husbands drink to excess.

In the long run we could expect that once Russia has sustained growth, violent crimes will be decreasing (say, homicide rate will decline together with other mortality indicators) as we can judge from our results. No doubt that Criminal Justice System has to be reformed because it could prevent further crime growth in Russia at some extent, but only if its development will be adequate to new conditions. Increasing level of education for young people can be resulted in their lower involvement in illegal activity today while they are studying and in future when they will be working. In this respect twelve years of secondary education is a good reform of education in Russia, which will improve the crime situation. And this is good news. But there is bad news. With higher drug consumption Russia will probably have further rise in either crimes. With better economic conditions violent crimes will be replaced by acquisitive crimes, what we observe now in developed countries. Higher income and unemployment rate could lead to more property crimes. The remedies that can prevent this rise in property and economic crimes exist maybe outside the economic sphere. From these facts we can sum up, that crime is a price paid for open society and growth.

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Appendix.

Table 1. Description of the variables used in the regressions.

Variable	Description
Homicide rate	Number of homicides per 100'000 population
Larceny rate	Number of larceny-thefts per 100'000 population
Clear-up ratio	Proportion of homicides (larceny-thefts) solved by Police
Alcohol consumption	Number of people hospitalized to stationary medical facilities with diagnosis of alcohol psychosis per 100'000 population
Drug consumption	Number of registered people with diagnosis of drug addiction, per 100'000 population
Real income	Average income in constant 1990 prices
Gini index	Income inequality measure, from 0 to 100
Unemployment	Unemployment rate, per cent
Educational level	Average years of schooling of population above 15 years of age
Net marriage	Number of marriages minus number of divorces, per 1'000 population
Urban population	Share of urban population, per cent
Ethnic population	Share of indigenous (non-Russian) population, per cent
Young population	Share of young population below 16 years of age, per cent
Latitude	Geographical latitude
Longitude	Geographical longitude

Table 2. Descriptive statistics for the homicide regression.

Variable	Obs.	Regions	Mean	Std Dev	Min	Max
Homicide rate	490	70	19.611	8.880	3.655	79.085
Clear-up ratio	490	70	80.543	10.017	22.200	94.200
Alcohol consumption	490	70	79.270	40.299	0.500	220.700
Drug consumption	490	70	49.335	57.587	2.100	372.100
Real income	490	70	149.488	80.815	35.000	628.000
Gini	490	70	34.131	6.267	16.913	60.109
Unemployment	490	70	9.814	4.693	2.800	30.800
Education level	490	70	9.373	0.473	8.681	11.107
Net marriage	490	70	2.571	0.916	-0.700	6.900
Urban population	490	70	70.320	11.612	36.957	100.000
Ethnic population	490	70	9.133	19.505	0.000	80.200
Young population	490	70	23.524	3.477	17.200	36.800
Latitude	490	70	54.643	5.286	43.000	68.000
Longitude	490	70	59.543	34.280	21.000	162.000

Table 3. Descriptive statistics for the larceny-theft regression.

Variable	Obs.	Regions	Mean	Std Dev	Min	Max
Larceny rate	420	70	904.244	333.276	153.031	2241.597
Clear-up ratio	420	70	49.279	11.131	18.700	83.500
Alcohol consumption	420	70	85.917	39.012	0.500	220.700
Drug consumption	420	70	53.984	59.947	2.200	372.100
Real income	420	70	150.519	83.908	35.000	628.000
Gini	420	70	34.042	6.233	16.913	60.109
Unemployment	420	70	10.592	4.585	3.300	30.800
Education level	420	70	9.373	0.473	8.681	11.107
Net marriage	420	70	2.523	0.887	-0.700	6.300
Urban population	420	70	70.245	11.670	36.957	100.000
Ethnic population	420	70	9.133	19.508	0.000	80.200
Young population	420	70	23.304	3.423	17.200	36.500
Latitude	420	70	54.643	5.287	43.000	68.000
Longitude	420	70	59.543	34.286	21.000	162.000

Table 4. GMM system regression results.

	Homicide			Larceny-theft		
	(1) OLS	(2) GMM level	(3) GMM system	(1) OLS	(2) GMM level	(3) GMM system
Criminal experience:						
crime rate (-1)	0.855***	0.896***	0.659***	0.839***	0.851***	0.855***
Strength of Police:						
clear-up ratio	-0.264***	-0.150***	-0.379***	-0.185***	-0.093***	-0.216***
Addictions:						
alcohol	0.025	0.015*	0.143***	-0.035*	-0.037***	-0.124***
drug	-0.004	-0.004**	0.008***	-0.006	0.006**	0.005
Social-economic indicators:						
real income	-0.024*	-0.018***	-0.059***	-0.004	0.007	0.058***
Gini	0.013	-0.030	0.106***	-0.020	-0.065***	0.017
unemployment	-0.043**	-0.014*	-0.067***	0.014	0.028***	0.023**
Education:						
educational level	-0.430**	-0.206**	-0.693***	-0.507***	-0.484***	-1.050***
Family:						
net marriage	-0.043	-0.022	-0.054***	-0.100***	-0.081***	-0.276***
Demography:						
urbanization	0.057	0.059***	0.050	-0.110**	-0.095**	-0.102***
ethnic structure	-0.003	-0.003**	0.000	-0.011***	-0.010***	0.003
young	0.329***	0.230***	0.668***	-0.046	-0.066	-0.180***
Geography:						
latitude	0.126*	0.072**	0.179***	0.123	0.182***	-0.050
longitude	0.019	0.005	0.087***	0.011	0.014*	-0.005
Obs.	490	490	490	420	420	420
Regions	70	70	70	70	70	70
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Wald test of joint significance of time dummies (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Wald test of joint significance (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Sargan test (p-value)	NA	0.366	0.199	NA	0.323	0.244
Test for first-order serial correlation (p-value)	0.007	0.008	0.001	0.538	0.542	0.000
Test for second-order serial correlation (p-value)	0.302	0.566	0.263	0.894	0.951	0.711

[1] List of instruments: second lag of crime rate (homicide or larceny-theft), first lag of respective clear-up ratio, alcohol, drug, real income, Gini, and unemployment. Other indicators are assumed to be exogenous and used to instrument themselves.

[2] List of instruments for the equation in first differences includes second lags of homicide rate, first lag of homicide clear-up ratio, alcohol and real income. For the equation in levels we used as instruments lagged first differences of homicide rate, clear-up, alcohol and real income. Other variables are exogenous.

[3] List of instruments for larceny-theft is similar to that for homicide system, but homicide rate and clear-up are replaced by larceny-theft rate and clear-up, and in equation in first differences drug is used as additional instrument.

Stars are usual confidence level: *** - 1 %, ** - 5 %, * - 10 %.

Table 5. Correlation matrix for the homicide regression.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1)	Homicide rate	1.00														
(2)	Lagged homicide rate	0.94	1.00													
(3)	Clear-up ratio	-0.11	-0.09	1.00												
(4)	Alcohol consumption	0.13	0.13	-0.05	1.00											
(5)	Drug consumption	0.36	0.41	-0.22	-0.12	1.00										
(6)	Real income	0.03	0.01	-0.09	0.38	-0.07	1.00									
(7)	Gini	0.25	0.25	-0.26	-0.01	0.25	0.34	1.00								
(8)	Net marriage	-0.12	-0.15	-0.18	-0.48	-0.07	-0.22	0.17	1.00							
(9)	Unemployment	0.18	0.26	-0.16	-0.11	0.37	-0.26	-0.04	0.01	1.00						
(10)	Latitude	0.11	0.10	0.34	0.44	-0.27	0.48	0.01	-0.48	-0.23	1.00					
(11)	Longitude	0.53	0.52	0.06	-0.05	0.27	0.05	0.05	-0.31	0.03	0.09	1.00				
(12)	Urban population	0.00	-0.01	-0.19	0.48	-0.05	0.36	0.05	-0.60	-0.24	0.48	0.13	1.00			
(13)	Ethnic population	0.17	0.18	-0.18	-0.38	0.05	-0.18	0.03	0.53	0.38	-0.28	-0.03	-0.47	1.00		
(14)	Education level	0.22	0.21	-0.45	0.15	0.23	0.40	0.31	-0.35	0.02	0.20	0.42	0.59	-0.01	1.00	
(15)	Young population	0.45	0.42	-0.05	-0.40	0.12	-0.03	0.15	0.37	0.16	-0.15	0.41	-0.48	0.65	0.08	1.00

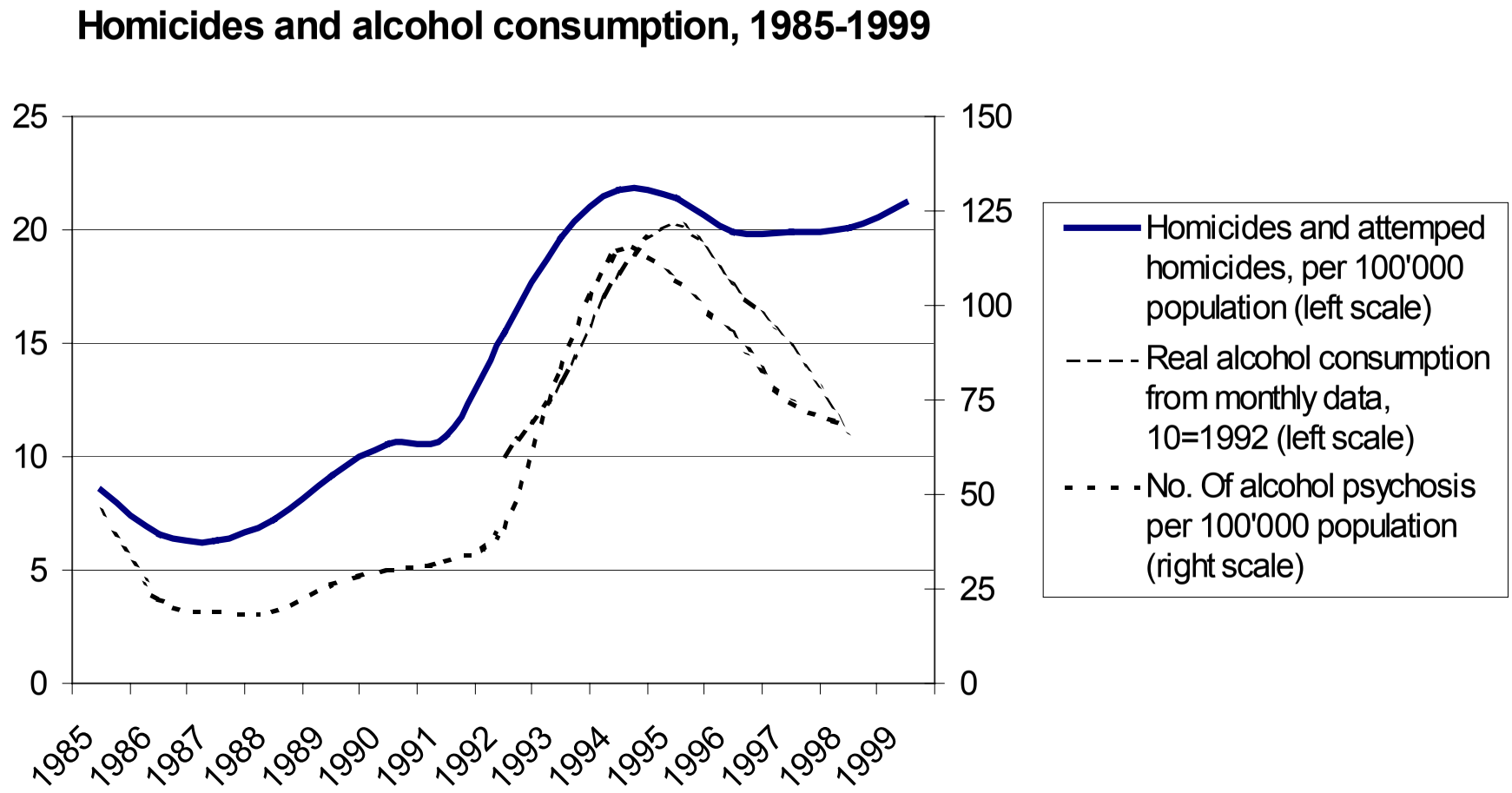
Table 6. Correlation matrix for the larceny-theft regression.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1)	Larceny-theft rate	1.00														
(2)	Lagged larceny-theft rate	0.93	1.00													
(3)	Clear-up ratio	-0.55	-0.57	1.00												
(4)	Alcohol consumption	0.27	0.29	-0.21	1.00											
(5)	Drug consumption	-0.03	-0.02	0.05	-0.22	1.00										
(6)	Real income	0.01	0.04	-0.29	0.41	-0.08	1.00									
(7)	Gini	-0.18	-0.11	-0.19	0.00	0.26	0.38	1.00								
(8)	Net marriage	-0.45	-0.44	0.03	-0.47	-0.06	-0.19	0.17	1.00							
(9)	Unemployment	-0.22	-0.24	0.32	-0.33	0.32	-0.31	-0.04	0.06	1.00						
(10)	Latitude	0.33	0.31	-0.23	0.48	-0.26	0.47	0.01	-0.48	-0.25	1.00					
(11)	Longitude	0.40	0.42	-0.28	-0.06	0.28	0.02	0.07	-0.32	0.03	0.09	1.00				
(12)	Urban population	0.19	0.19	-0.25	0.53	-0.05	0.37	0.05	-0.59	-0.27	0.48	0.13	1.00			
(13)	Ethnic population	-0.34	-0.30	-0.03	-0.43	0.04	-0.18	0.03	0.52	0.43	-0.28	-0.03	-0.47	1.00		
(14)	Education level	0.03	0.07	-0.35	0.16	0.24	0.41	0.31	-0.33	0.01	0.20	0.42	0.59	-0.01	1.00	
(15)	Young population	0.03	0.07	-0.31	-0.37	0.15	-0.05	0.16	0.37	0.25	-0.17	0.40	-0.50	0.67	0.07	1.00

Figure 1.


25 to 85 (21)
20 to 25 (24)
17 to 20 (16)
8 to 17 (25)
Number of homicides per 100'000 population, 1998.

Figure 2.


Homicides and alcohol consumption, 1985-1999
25
20
15
10
5
0
150
125
100
75
50
25
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
Homicides and attemped homicides, per 100'000 population (left scale)
Real alcohol consumption from monthly data, 10=1992 (left scale)
No. Of alcohol psychosis per 100'000 population (right scale)